ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
Index Copernicus Value: 49. 23
PubMed - National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 3, Issue –4, August - 2018, Page No. : 54 - 62

Effect Of Ergonomic Education And Training On Self Reported Musculoskeletal Pain, Workstation Habits And Psychological Wellbeing In Computer Users.

Dr. Pooja M. Akhtar, M.P.Th, Asst. Professor, V.S.P.M's College Of Physiotherapy, Digdoh Hills, Hingna, Nagpur.
Dr Mansi. Kashyap, B.P.Th, V.S.P.M's College Of Physiotherapy, Digdoh Hills, Hingna, Nagpur.
Corresponding Author: Dr. Pooja M. Akhtar, M.P.Th, Asst. Professor, V.S.P.M's College Of Physiotherapy, Digdoh Hills, Hingna, Nagpur, India- 440019

Type of Publication: Original Research Article
Conflicts of Interest: Nil

I. Introduction

Technological advances, peculiarly, invention of computers, have revolutionized the way of our working. Computers have now become an integral part of our life. However, its use is not at all free from health hazards.[1]

Prolonged use of computer puts excessive strain and stress on the working muscles, as well as spinal joints, because of repetitive and continuous nature of movements. Individual factors, poor workstation design and psycho-social surroundings can lead to development of symptoms of musculoskeletal discomfort (MSD).[1].

If these symptoms are neglected and if no preventive steps are taken, cumulative trauma disorders such as myofascial syndromes, myalgia, nerve entrapment syndromes, epicondylitis, tendonitis and tenosynovitis can arise.[2]

Neck or shoulder stiffness; neck or shoulder pain; tingling/numbness in hands, thumbs or fingers during or after working hours; hand and wrist pain; backache; headache; leg cramps; leg stiffness; numbness in ankles and feet; swelling in ankles and feet; reduction in strength of hand and difficulty in grasping objects are considered one or more musculoskeletal discomfort (MSD) symptoms reported by the respondents [1].

Musculoskeletal discomfort (MSD) is commonly reported by office workers worldwide, and it can have detrimental effects on workers' productivity and health. [3-5]

Ergonomic factors, such as awkward posture, poor work-place design, inadequate work rest cycles, continuous and repetitive nature of movements, excessive force, use of keyboards and other input devices have been implicated in the development and/or exacerbation of work-related symptoms and cumulative trauma illness or injuries leading to poor work outout.[6]

Exposure to high work pressure, poor work-life balance, can lead to major problems with well-being and mental health at work. The psychosocial work environment affects an individual's motivation to work safely, the attitude towards personal health and safety, and willingness to seek health care.[7]

To prevent MSDs, from progressing and becoming more chronic, awareness and knowledge of the relationship between computer usage and MSDs are essential.[8]

Ergonomic education and training is known to produce positive effects on MSDs , however the effects of such intervention on individual factors such as pain, ergonomic factors such as workstation habits and psychological

factors such as psychological well-being has not been previously studied in a homogenous population.[9].

Hence, the present study was undertaken to evaluate the effects of ergonomic education and training on self-reported musculoskeletal pain, workstation habits and psychological well-being in computer users.

II. Materials And Methods

II.A Study design

An interventional, before and after effect evaluation case series was undertaken after Ethical approval was obtained from Institutional Ethics Committee of NKP Salve Institute of Medical Sciences. Permission was sought from the Head of the Human Resource Department of NKP Salve Institute of Medical Sciences and purpose of our visit was explained with a request to grant us the permission for carrying out this study among computer users of the institute.

II.B Participants and setting

The inclusion criteria were subjects in age group between 30-50 years, either gender, who worked with computers for more than 5 years, reported musculoskeletal pain with a minimum of 3 score on NPRS. Subjects were clerical staff working in various academic departments including administrative blocks, registration counters and HR department of N.K.P.Salve Institute of Medical Sciences. Subjects who had any previous illness and/or injuries that may have contributed to MSD in the past 6 months and not willing to participate were excluded.

II.C Intervention

After obtaining the requisite permission, the subjects who fulfilled the inclusion criteria were explained the purpose and procedure of our study. Informed written consent was obtained from each subject willing to participate. Each subject was evaluated to check their body postures and workstation habits using Office Ergonomic Evaluation Checklist [8] without disturbing their work schedule in their static postures that they were adopting. The subjects were told to report any pain and was recorded on a body chart and rated on Numerical Pain Rating Scale (NPRS) [10]. Their baseline Psychological well-being was assessed using Warwick-Edinburg Mental Well-being scale (WEMWBS)[11] to document their current status of mental health.

Intervention consisted of Ergonomic training and ergonomic education program, conducted in groups, two contact sessions per week. The education consisted of lectures on office ergonomics using power-point presentations, understanding the relationship between office ergonomics and the development of MSDs, ergonomic adjustments of workstations, and role of workstation exercises to combat MSDs. The training consisted of graded segmental mobility and stretching exercise which were performed during break time in 3 sessions planned throughout the day **(Appendix 1).**The physiotherapists also encouraged the subjects to work at their workstation in their working postures so that they could help them readjust their workstations effectively and reminders were given with the help of ergonomic hand-outs, exercise posters, e-mail, telephonic reminders and surprise visits by the physiotherapists.

Post intervention data was recorded and subjected to appropriate statistical tests.

II.D Outcome measures

The primary outcome measure was self-reported MSDs and rating on NPRS. [10]

Subjects were asked if they had experienced any aches, pains, discomfort or numbness in any part of the body regions at any time during the previous 6 months as a result of working with a computer (yes/no). Data concerning the prevalence of MSDs were gathered and rated using the Numerical pain rating scale.

Workstation habits and psychological well-being were the secondary outcome measures. Each subject was evaluated with Workstation observation checklist in their working

© 2018 IJMSIR, All Rights Reserved

postures [8]. Workstation observations were conducted prior to intervention to get actual observation of office workers with the help of workstation checklist [8].The rating was either yes (if the respondents had ergonomically correct use of computer) or no (if the respondents had faulty or ergonomically poor use of computer) [8]. The observation checklist included items related to the use of the monitor (5 items), keyboard (7 items), mouse (2 items), chair (7 items), and desk (2 items). [8]

Psychological well-being was assessed using Warwick-Edinburg Mental Well-being scale (WEMWBS)[11].WEMWBS is a 14 item scale of mental well-being covering subjective well-being and psychological functioning, in which all items are worded positively and address aspects of positive mental health. The scale is scored by summing responses to each item answered on a 1 to 5 Likert scale. The minimum scale score is 14 and the maximum is 70. [11]

II.E Statistical analysis

Paired t test was used to analyse the significant differences between pre and post intervention scores of NPRS, scores of positive responses on checklist and psychological well-being scores. The level of significance was set at p value <0.05.

III. Results

III.A Baseline results for demographic and occupational characteristics

The demographic and occupational characteristics of the study population are presented in Table I and Table II.

Table I: Demographics of study population

Personal characteristics: Age and gender	N	Mean	SD (±)
Male	23	45.21	±8.42
Female	17	36	±8.04
Age	40	41.3	±7.34

Table II: Occupational characteristics of study population

Occupational characteristics	Mean	SD (±)
Years of working using computer	14.25	±9.02
Hours sitting while using computer per day	7.35	±0.69

III.B Self-reported musculoskeletal discomfort (MSDs)

The results show that the percentage of subjects who reported MSDs was consistently reduced at all regions at the end of intervention. These improvements were seen with the neck (67.5% to 15%), Shoulder (60% to 5%), Upper back (25% to 5%), wrist (12.5% to 0%), low back (31.2% to 20%), elbow (10% to 2.5%), knee (12.5% to 7.5%), hip and ankle (5% to 0%). On comparing the pre and post NPRs scores, there was a statistically significant reduction in pain scores observed after 8 weeks of intervention. Mean scores and p and t value of MSD reported on NPRS are presented in Table IV.

III.C Psychological well-being

Effects of the intervention showed statistically significant differences for improved well-being scores (p value< 0.0001). Mean scores and p and t value of mental well-being scores are presented in Table V.

III.D Workstation observation checklist

The mean number of positive responses improved after intervention and showed statistically significant difference. Mean scores and p & t value of the responses on Workstation observation checklist are presented in Table VI.

Significant improvements were observed with ergonomic education on percentage of positive responses obtained in

© 2018 IJMSIR, All Rights Reserved

workstation habits documented using workstation observation checklist presented in the Table VII.

IV. Discussion

Ergonomic education and training regarding workstation habits as a primary intervention has beneficial effects on workstation practices, lower self-reported musculoskeletal discomfort and increased feeling of well-being among computer users.The findings of our study suggest that ergonomic education improved workstation habits with respect to how workers used their monitor, keyboard, mouse, chair, and desk after 8 weeks post-intervention. Our findings are consistent with the study of Harrington SS, et.al who proved that ergonomics training improved workstation habits.[12&13]

Significant improvements were also found regarding the position of the key-board, worker's body posture for the elbow, forearm, upper arm, wrist, and shoulders when typing and worker's body posture for lumbar support, thighs, knees and feet while sitting. Our findings are supported by other studies which showed that computing body postures and workstation ergonomic practices improve after ergonomic training.[14] It is evident from the study of Hannan LM, et.al that computer related morbidity has become an important occupational health problem and is a matter of great concern.[15]

This study has also brought into focus, factors such as lack of awareness regarding good ergonomics, improper static and faulty postures during working hours and lack of exercises contributing to occurrence of Musculoskeletal discomfort. After the intervention in forms of exercises and education, the pain due to musculoskeletal discomfort decreased from a mean score 6.021 ± 1.54 to 1.25 ± 0.35. The decrease in pain could be attributed to good posture maintained while using computers, workstation exercises performed during refreshment breaks and awareness regarding faulty posture and correct ergonomic setting that was given in the form of intervention in this present study. Our results are in line with Rizzo TH, et al. [14]

The positive impact of workstation education and training on reduction of musculoskeletal discomfort could be explained with the reference to the health behaviour module which stated that the perceived health threat directs the individual towards healthy behavioural changes.[16]

The total number of positive responses on ergonomic check-list improved from 437 to 694 suggesting that the subjects were aware of the correct ergonomic posture to be maintained with correct positioning of equipment. Our study showed that the training session, the help and guidance given by physiotherapist, and the active participation of workers in their workstation adjustments showed positive improvement in workstation ergonomic practices.

Our study showed improvement in the mean well-being scores from 44.9 ± 5.38 to 49.57 ± 4.98. The subjects reported improved well-being feeling that could be due to reduced MSD while working, good health-work-life balance, and improved psycho-social work environment. Our findings are in agreement with Faucett J, et.al who reported that ergonomic training improved the health status and reduced the subject's psychosocial work stress perceptions and psychological well-being.[7&17]

The improvement in workstation habits benefited workers in terms of having good body postures while using computers, which lowered the self-reported musculoskeletal complaints and thus the reduced pain scores on NPRS. Our results are quite consistent with the previous studies which indicate that training along with education, in correct interaction with one's workstation habits have significant benefits to workers in terms of their musculoskeletal discomfort, and thus improved mental wellbeing.

© 2018 IJMSIR, All Rights Reserved

V. Conclusion

The current study was a preliminary report to determine the effectiveness of office ergonomic training and education to reduce musculoskeletal discomfort in computer users. We found that office ergonomic training and education improved workstation habits, psychological well-being and reduced musculoskeletal discomfort among the computer users. We hope that the results will benefit the subjects because they demonstrate to the management that inexpensive ergonomic education and training had a positive impact on the safety and health of computer users. Further research that combines training and the use of adjustable furniture is recommended in the future.

Acknowledgment: Authors would like to thank Dr. Murtuza. Akhtar, Professor and Head, Department of Surgery, N.K.P.Salve Institute of Medical Sciences, for his methodological support and critical appraisal.

Table III shows the detailed distribution of MSD at various sites and percentage of subjects who reported with MSD.

Sr. No	Affected body parts	No of subjects	Percentage	Sr. No	Affected body parts	No of subjects	Percentage
1	Neck	27	67.5%	1	Neck	6	15%
2	Shoulder	24	60%	2	Shoulder	2	5%
3	Low back	12	31.2%	3	Low back	8	20%
4	Upper back	10	25%	4	Upper back	2	5%
5	Wrist/hand	5	12.5%	5	Wrist/hand	0	0%
6	Knee	5	12.5%	6	Knee	3	7.5%
7	Elbows	4	10%	7	Elbows	1	2.5%
8	Hip	2	5%	8	Hip	0	0%
9	Ankle	2	5%	9	Ankle	0	0%

Table IV shows mean scores of NPRS pre and post intervention with the p value.

Parameter	Pre Intervention		Post intervention		t-value	P-value
	Mean	SD (±)	Mean	SD(±)		
NPRS	6.025	1.54	1.25	0.35	19	<0.0001

© 2018 IJMSIR, All Rights Reserved

Table V shows mean scores of WEMWBS pre and post intervention with the p value.

Parameter	Pre Intervention		Post intervention		t-value	P-value
	Mean	SD (±)	Mean	SD (±)		
WEMWBS	44.9	5.38	49.57	4.98	15	<0.0001

Table VI shows mean scores of positive responses on Workstation observation checklist pre and post intervention with the p value.

Parameter	Pre Intervention		Post intervention		t-value	P-value
	Mean	SD (±)	Mean	SD (±)		
Workstation observation checklist	11.75	2.70	20.25	1.70	16.53	<0.0001

Table VII shows percentage of positive responses obtained in workstation habits among computer users.

MOUSE	**Number of YES (pre)**	**Number of YES (post)**
1. Mouse is placed close to keyboard and within reach (at elbow height)	21	32
2. Wrist in a straight or neutral position	17	33
CHAIR		
1. Adequate back support	22	37
2. Back posture 90° to 110°	13	35
3. Feet touching supported by the floor or footrest	25	34
4. Thigh parallel with the floor	24	37
5. Upper body straight	12	39
6. Knee are about the same height as the hip with the feet slightly forward	26	37
7. Allow special clearance to move knee and less under the desk or keyboard tray	24	38
DESK		

© 2018 IJMSIR, All Rights Reserved

1. There is enough room for legs to comfortably fit under the desk	26	35
2. Item used most often are within arm length of reach	18	39
MONITOR		
1. Monitor is at arm's length away from user	20	39
2. Top of the monitor at eye level or slightly below	20	36
3. Centre of monitor place directly in line with middle of body, spacebar, and keyboard	19	38
4. Glare is minimized	22	39
5. Head in neutral position without straining forward and backward	11	39
KEYBOARD		
1. Keyboard at the right height (elbow height)	23	39
2. Keyboard positioned in front of user	16	37
3. Elbow at side and angle about 90° to 110°	23	39
4. Forearms parallel to floor	15	37
5. Wrist are straight (without flexing up or down) and flat	21	36
6. Upper hands and elbows close to the body when hands on the keyboard	20	34
TOTAL	437	694

VI. References

[1]. Dinesh Bhanderi, SK Choudhary, Lata Parmar, Vikas Doshi**.** A Study of Occurrence of Musculoskeletal Discomfort in
Computer Operators. Indian Journal of Community Medicine. 2008;**33**(**1**)

[2].Parker KG, Imbus HR. Cumulative trauma disorders,Current issues and ergonomic solutions: A systems approach. Lewis Publishers: USA; p. 71-88.

[3]. Sillanpaa J, Huikko S, Nyberg M, Kivi P, Laippala P, Uitti J. Effect of work with visual display units on musculo-skeletal disorders in the office environment. *Occup Med.* 2003;**53**(**7**):443–451.

[4]. Nakazawa T, Okubo Y, Suwazono Y, Kobayashi E, Komine S, Kato N, et al. Association between duration of daily VDT use and subjective symptoms. *Am J Ind Med.* 2002;**42**(**5**):421–426.

[5]. Halford V, Cohen HH. Technology use and psychosocial factors in the self-reporting of musculoskeletal disorder symptoms in call center workers. *J Safety Res.* 2003;**34**(**2**):167–173.

© 2018 IJMSIR, All Rights Reserved

[6].Demure B, Luippold RS, Bigelow C, Ali D, Mundt KA, Liese B. Video display terminal workstation improvement program: I. Baseline associations between musculoskeletal discomfort and ergonomic features of workstations. *J Occup Environ Med*. 2000;**42(8)**:783–791

[7]. Faucett J, Rempel D. VDT-related musculoskeletal symptoms: Interactions between work posture and psychosocial work factors. *Am J Ind Med*. 1994;**26(5)**:597–612.

[8]. Norashikin Mahmud, Dianna Theadora Kenny, Raemy Md Zein, Siti Nurani Hassan.Ergonomic Training Reduces Musculoskeletal Disorders among Office Workers: Results from the 6-Month Follow-Up. *The Malaysian journal of medical sciences:MJMS 2011;* **18(2)**, 16.

[9].Westgaard RH, Winkel J. Ergonomic intervention research for improved musculoskeletal health: A critical review. *Int J IndErgonom*. 1997;**20(6)**: 463–500.

[10]. Gretchen A Roman, Vincent Samar. Workstation ergonomics improves posture and reduces musculoskeletal pain in video interpreters. *Journal of interpretation 2015;* **24 (1)**, 7.

[11]. Elient Flint, Steven Cummins, Jane Wills. Investigating the effect of the London living wage on the psychological wellbeing of low-wage service sector employees: a feasibility study. *Journal of Public Health. 2013;* **36(2)**, *187-193.*

[12]. Greene BL, DeJoy DM, Olejnik S. Effects of an active ergonomics training program on risk exposure, worker beliefs, and symptoms in computer users. *Work*. 2005;**24(1)**:41–52.

[13]. Harrington SS, Walker BL. The effects of ergonomics training on the knowledge, attitudes, and practices of teleworkers. *J Safety Res*. 2004;**35(1)**:13–22.

[14]. Rizzo TH, Pelletier KR, Serxner S, Chikamoto Y. Reducing risk factors for cumulative trauma disorders (CTDs): The impact of preventive ergonomic training on knowledge, intentions, and practices related to computer use. *Am J Health Promot*. 1997;**11(4)**:250– 253.

[15]. Hannan LM, Monteilh CP, Gerr F, Kleinbaum DG, Marcus M. Job strain and risk of musculoskeletal symptoms among a prospective cohort of occupational computer users. *Scand J Work Environ Health*. 2005;**31(5)**:375–386.

[16]. Glanz K, Lewis FM, Rimmer BK. Health Behaviour and Health Education: Theory and Research Practice. 2nd ed. San Francisco, CA: Jossey-Bass; 1997.

[17]. Robertson MM, Huang YH, O'Neill MJ, Schleifer LM. Flexible workspace design and ergonomics training: Impacts on the psychosocial work environment, musculoskeletal health, and work effectiveness among knowledge workers. *Appl Ergon*. 2008;**39(4)**:482– 494.

© 2018 IJMSIR, All Rights Reserved

APPENDIX-1Ergonomic Intervention: Exercise module designed for the computer workers.

SESSION 1 (11:30 am)	SESSION 2 (1:30 pm)	SESSION 3 (4:30 pm)
1. Shoulder	**1.Trunk**	**1.Knee**
a. Shoulder stretch (front)	a. Trunk rotation	a. Knee to chest
b. Shoulder stretch (back)	b. Side stretch	b. Hamstring stretch
c. Shoulder pull	c. Forward flexion	c. Quadriceps stretch
d. Shoulder circumduction	d. Overhead stretch	**2. Ankle**
2.Elbow	**2.Neck**	a. Plantar-flexion
a. Triceps stretch	a. Neck stretch (back)	b. Dorsi-flexion
b. Biceps stretch	b. Neck stretch (front)	c. Draw a circle
3. Wrist and forearm	c. Neck stretch (side)	
a. Wrist /forearm stretch		

- Mobility Exercises: 10 repetitions of each exercise.
- Stretching Exercises: 5 repetitions with 10 sec hold of each exercise.

© 2018 IJMSIR, All Rights Reserved